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ABSTRACT

A study was conducted to examine patterns of information processing over time in self-analytic groups. Communication patterns in two 25-member groups of college students that met for 32 50-minute sessions were categorized by means of the Systems Information Processing Analysis (SIPA) category system. Messages were coded on four dimensions of information processing: (1) source of information, (2) time orientation, (3) evolution of information, and (4) reduction of equivocality. The sequence of coded messages was then measured for fit with a first order Markov chain model. The results indicated that the communication data from the two groups were first order, that the groups were nonhomogeneous, that stereotypy (predictability of patterns) was low to moderately high across the four dimensions, and that patterns in the evolution-of-information dimension were stationary or stable over time. Patterns in the three other SIPA dimensions were nonstationary (time dependent) for both groups, suggesting cyclical stages of development. (Author/FL)

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A STOCHASTIC ANALYSIS OF COMMUNICATION DEVELOPMENT IN SELF-ANALYTIC GROUPS

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The communication in two, 25 member groups which met for 32, 50 minute sessions was categorized by means of the Systems Information Processing Analysis (SIPA) category system. Messages were coded on four dimensions of information processing: (1) Source of Information, (2) Time Orientation, (3) Evolution of Information, and (4) Reduction of Equivocality. The sequence of coded messages was then measured for fit with a first order Markov chain model. The results indicated that the communication data from the two groups were first order; the groups were nonhomogeneous; stereotypy (predictability of patterns) was low to moderately high across the four dimensions; patterns in the Evolution of Information dimension were stationary or stable over time. Patterns in the three other SIPA dimensions were nonstationary (time dependent) for both groups, and suggested cyclical stages of development.

A STOCHASTIC ANALYSIS OF COMMUNICATION DEVELOPMENT IN SELF-ANALYTIC GROUPS[1]

The temporal patterning of interactive behavior in small groups has been an important issue in behavioral science as reflected in the theorizing of Bennis and Shepard (1956), Bion (1959), Schutz (1958), and Tuckman (1965); and the empirical research of Bales (1950), Dunphy (1968), Ellis (1977), Fisher (1970) and others. Unfortunately, research on developmental processes in small groups has often been repetitious with narrow focus, and the field remains as McGrath and Altmann (1966) found it more than a decade ago: abounding in data, but lacking in fundamental knowledge of group process. The present study examines the phasic development of verbal information processing behavior over the entire history of two similar self-analytic groups,[2] and attempts to overcome some of the major barriers to progress in group developmental research.

PROBLEMS IN PREVIOUS RESEARCH

First, researchers have tended to assume that groups complete full life cycles (e.g., Bennis & Shepard, 1956; Hill & Gruner, 1973; Mann, 1966; Psathas, 1960). Many studies of decision-making groups define life cycle as the completion of the group task. For Bales and Strodtbeck (1951), e.g., the cycle of group life lasts "from the recognition of a topical problem to its disposition by the group [p. 487]." Groups which did not fulfill these criteria were not included in the study. Such distinctions do not apply, however, to self-analytic groups, since

the task in these groups is increased self-awareness or personal growth, an achievement which is difficult to assess. Many self-analytic groups may not complete full developmental cycles. Yet, existing phase models fail to provide a means for determining how far a given group has developed. Observations of self-analytic groups are analyzed by applying full phase models without testing to determine whether this procedure is valid.

Applying a full life model to every group is analogous to applying a birth-growth-maturity model to individuals, regardless of age. This model applies to a twenty-one year old or a seventy-five year old might indicate that each individual had passed through birth, growth and maturity phases without showing how distinctive these patterns were for each person. The problem is compounded if one applies a birth-growth-death model, since the birth and death stages would be conceptually similar (origination-termination) for all. Yet, one could hardly say that a twenty-one year life span and a seventy-five year life span represented similar patterns of development, even though both might represent birth-growth-death stages. In this study, the actual level of development attained by each group is determined from the analysis.

A second problem, closely related to the first, is that most investigators of small group development have tended to take a macroscopic view, and have formulated general developmental models (e.g., Bales & Strodtbeck, 1951; Braaten, 1975; Hill & Gruner, 1973; Mills, 1964; Tuckman, 1965). Tuckman's (1965) four stage model (forming, storming, norming and performing), a composite of fifty previous models, is a typical macro view. Just as the individual may pass through many important substages from the "terrible twos," through adolescence, middle age, a "second childhood," etc., so also

may the group pass through many important substages. One must examine development more microscopically by assessing behavior within major stages to increase information yield from developmental research. This study takes a microscopic view by allowing up to eight phases to emerge from the data.

Third, most phase models offer rigid prescriptions of group behavior, and assume that all groups follow a similar sequence of development. Many researchers collapse groups and apply developmental models to what amounts to a composite of groups (e.g., Levine, 1971; Mann, 1966; McMurrain & Gazda, 1974; Psathas, 1960). This is analogous to expecting all people to follow similar patterns from birth to maturity. As argued above, it is possible that different types of groups differ in developmental patterns, but that fine distinctions are obscured by treating all groups alike. It is also possible that even similar kinds of groups do not always follow the same developmental pattern. Even within a very general framework of development, individual groups may show considerable variation from the expected pattern. In this study groups will be tested for homogeneity of developmental patterns before collapsing. Nonhomogeneous groups will be analyzed separately.

Fourth, most models predict linear and progressive changes in group behavior (e.g., Bales & Strodtbeck, 1951; Braaten, 1975; Hill & Gruner, 1973; Martin & Hill, 1957; Tuckman, 1965). Groups are expected to develop steadily to a mature "work" stage often characterized by a preponderance of "here and now" communication, and other personal growth facilitating behaviors (See, e.g., Egan, 1970; Yalom, 1970). There has been little investigation of regression or multiple passes through a similar stage, as in individual development. The individual

experiences instances of starting over, learning new skills, or "passages" as Sheehy (1974) terms them.

Fifth, previous studies have not developed a clear conceptualization of "phase." This study defines phases in terms of patterns of acts and interacts. The means for defining phases are specified a priori; however, the nature of the developmental pattern will emerge from the data. The number of phases and their characteristics are determined from the analysis, by grouping time periods designated as similar into a phase, and identifying the characterizing behaviors in the phase. The number of phases is partially constrained by limitations of the model, such as the minimal amount of data necessary to constitute a time period; and the characterization of phases is constrained by the boundaries of the category system. However, in the present study both a Markov model and the SIPA category system are used, because they are less restrictive than tools used in previous research. The Markov model allows up to eight phases to be identified, and SIPA categorizes a broad range of communicative functions.

METHOD

Sample

Two groups were selected as appropriate for this research. Each group consisted of twenty-five Harvard University students enrolled in a course in social psychology, Social Relations 100. Thirty-two fifty minute sessions were held. The groups participating in this research are characterized as "self-analytic." The principle objective of such groups is to learn more about interpersonal functioning and group process by studying the group's own behavior.

One group was led by Richard Mann, a social psychologist, the other by Walter Aifield, a psychiatrist. Both leaders adopted a

non-directive style. They made few attempts to lead or direct the groups other than by briefly interpreting the group process and occasionally reminding the groups to "work."

All of the sessions for each group were tape-recorded in the early nineteen sixties. The final data base for Group I was a written transcript of 28 sessions provided by Professor Mann. The data for Group II were the audio tapes of the entire 32 sessions. The total sample consisted of 5,371 message units, 2,386 from Group I and 2,985 from Group II. Four segments, each five minutes in length, were sampled from each fifty minute session of each group. The first five minutes of each session was sampled, and subsequent five minute samples were then taken after each ten minute interval. In all, twenty minutes, which constituted forty percent of each session was coded. This sampling procedure was adopted in order to retain as much data as possible for analysis; to ensure that each group session or meeting was represented equally; and to preserve the naturally occurring divisions of the data (i.e., group sessions).

Coding System

The tapes and transcripts were coded by two coders trained by the investigator for approximately fifteen hours, in using the Fisher, Drexel and Werbel (1977) Systems Information Processing Analysis (SIPA) category system. SIPA categorizes each message—each verbal utterance by a single individual until interrupted by another person—along four separate dimensions of information processing.

Dimension One categorizes the systemic Source of Information as Individual, Group-system, Immediately Environing System (the group's next higher suprasystem) or Environment. Dimension Two classifies the temporal aspect of communication into Past-to-present, Present-

to-present, Future-to-present, and Timeless Present (generalizable across time boundaries, e.g., after a war) categories. "To-present" occurs in the category label because all exchanges of messages occur in the present. Dimension Three classifies the Evolution of Information. The four categories are: (1) introducing or requesting new information (Enactment), (2) extended agreement (Positive Selection), (3) disagreement (Negative Selection) and (4) neutrality; asks for or gives a neutral opinion rather than information (Retention). Dimension Four categorizes equivocality. The five categories range from Maximum Reduction of Equivocality represented by messages with high certainty and providing clear-cut, singular interpretation to Maximum Increase of Equivocality represented by uncertainty and messages providing multiple interpretations.

The four dimensions of SIPA are embedded in a conceptual formulation based on general systems theory. Fisher, Drexel and Werbel's basic assumption is that, "communication always occurs in a social setting and serves to organize the relationship among people within that setting [p. 2]." The social setting is a social system in which the central function is information processing. Two compelling reasons for using SIPA are: (1) that it focuses on information processing, an essential component of communication, and (2) that it focuses on several important aspects of small group communication—time, source, function and clarity. See Fisher (1976) and Fisher, Drexel and Werbel (1977) for a more complete discussion of SIPA.

In the present study each coder was responsible for coding one of two groups. Coders were instructed to code each message, a message being defined as each verbal utterance by a single individual until interrupted by another person. This definition of message is consistent

with the one generally used in Markov analysis (e.g., Ellis & Fisher, 1975; Parks, Farace & Rogers, 1975; Parks, Farace, Rogers, Albrecht & Abbott, 1976), and proposed for interaction research (e.g., Rogers & Farace, 1975). The contiguity of messages was preserved by coding the interact, two messages in sequence, as well as individual acts. Every message was coded on all four dimensions of SIPA; thus each message received four separate codes. Coders were unaware of the specific purpose of the study.

Act by act inter-coder reliability was calculated for a sample of 295 messages from Group I, and 280 from Group II (approximately ten percent of the coded messages from each group). Twelve segments, each five minutes long were randomly selected from among the coded messages for each group. Each selected interval was coded a second time by a new coder and compared with the original codings, act by act.

Guetzkow's (1950) procedures for measuring obtained agreement (P'), the lower limits of the theoretical proportions of agreement (P), and the probability of a coder correctly classifying a unit (p) were employed as measures of inter-rater reliability. Guetzkow's obtained agreement values (P') ranged from .79 to .95 over the two groups, yielding lower limits of the theoretical proportion (P) values of .72 to .84 ($p < .01$) for Group I and .75 to .90 ($p < .01$) for Group II over the four dimensions of SIPA. The estimate of the probability with which a coder correctly classifies any unit (p) ranged from .81 to .89 for Group I, and from .82 to .92 for Group II. These values are consistent with previous reliability estimates for SIPA (see Fisher, Drexel & Werbel, 1977; Fisher, Glover & Ellis, 1977).

Statistical Analysis

The data were subjected to a series of statistical tests to measure the fit of the Markov model to group communication in accordance with procedures for conducting a Markov analysis (see, e.g., Anderson & Goodman, 1957; Fisher, Glover & Ellis, 1977; Hawes & Foley, 1976; Kullback, Kupperman & Ku, 1962). The fit of the model generates descriptive and explicatory information about group information processing behavior over time Since the dimensions of SIPA are theoretically independent, each of the four dimensions was treated as a separate category system; therefore, the statistical tests were conducted independently for each dimension for each group.

Matrices consisting of the frequency of occurrence of each state (coded category) for clusters of four meetings in sequence were compiled. Sessions were clustered rather than analyzed individually in order to provide sufficient data for the creation of a meaningful matrix.[3] The minimum number of sessions necessary to create a matrix were used in order to allow the emergence of the maximum number of phases. Each cluster was thereafter treated as a distinct time period. The data for each group were, thus, divided into eight time periods. For Group II, sessions one to four, five to eight,...29 to 32 were clustered, providing eight separate matrices or time periods. For Group I frequency matrices were created in the same way with the exception that sessions 6, 15, 18, and 27 were missing from the data provided by Mann.

A test of stereotypy was conducted for each time period for each group. The stereotypy measure was based on a test described by Altmann (1965). Stereotypy provides a statistical measure of the structure or constraint in the communication system. The theoretic

range of stereotypy is from zero to one. The zero end of the range represents behavior that is completely random, while one (1) represents behavior that is completely predictable, i.e., is completely structured. Stereotypy was calculated at the interact level for the eight time periods and composite for each dimension of SIPA. In addition to the stereotypy test, tests of the three basic assumptions (order, homogeneity and stationarity) underlying the Markov model were undertaken.

The test of order was performed according to Kullback, Kupperman and Ku's (1962) specifications. In a first order chain each state (defined by a category of the coding system) is dependent only upon the immediately preceding state. In a second order chain the dependency extends to two preceding states, and so on. The hypotheses that the data were of order one, two, three or four were tested.

The Markov model assumes that transition probabilities of all subgroups of the population are homogeneous (H_0: Group I = Group II = Composite). The homogeneity assumption was tested according to a test developed by Kullback, Kupperman and Ku (1962).

The test for stationarity was carried out according to Anderson and Goodman's (1957) specifications. To test for stationarity in each self-analytic group, each of the eight time periods was tested against a composite formed by combining all eight time periods for each dimension. In a stationary Markov chain there are no statistically significant differences between each time period and the composite of a dimension in terms of transition probabilities from category to category.

Research Questions

The date analysis tested the fit of the Markov chain model to information processing behavior in self-analytic groups over the life

span of the groups. The purpose of the study was to describe the pattern of information processing behavior over time, and to determine the dependencies among communicative acts for each of the four dimensions of SIPA by calculating the order of the chain and stereotypy of the time periods. The questions addressed in the analysis are:

(1) How many phases or distinct periods will emerge from each group's communication?

(2) What is the nature of the phases; how do they differ?

(3) Is development linear or nonlinear; what are the patterns of change:

(4) Is development progressive and to a higher order "work" stage?

(5) Is both groups' development the same or different?

RESULTS

Results of the stereotypy, order, homogeneity and stationarity tests are reported here. Significance at $p < .01$ is reported for all tests.

Stereotypy

For Group I, stereotypy ranged from .1535 (low predictability) for the composite of all of the time periods of Dimension Four (Reduction of Equivocality), to .4599 (moderate predictability) for the composite of Dimension Two (Time Orientation). The range in the separate time periods was from a low of .1312 (low predictability) in Dimension Four during the third time period to .5476 (moderately high predictability) in Dimension Two during the second time period. The composites of Dimensions One (Source of Information) and Three (Evolution of Information) were moderately predictable with stereotypys of .3429 and .3509.

Stereotypy for Group II ranged from .2241 (low predictability)

for the composite of Dimension Four (Reduction of Equivocality) to .4865 (moderate predictability) for the composite of Dimension One (Source of Information). The range over the separate time periods over the four dimensions was from .1790 (low predictability) in Dimension Four during the first time period to .6296 (moderately high predictability) in Dimension One during the sixth time period. The composites of Dimensions Two (Time Orientation) and Three (Evolution of Information) had stereotypys of .3956 and .2897.

For Groups I and II, Equivocality Reduction had the least predictable transitions of all the dimensions. Source of Information, Time Orientation and Evolution of Information for Group I, and Source of Information and Time Orientation for Group II were all moderately predictable with moderately high predicatability for some time periods. The transitions from the four categories of each of the moderately predictable dimensions were most often to only one or two of the categories.

Order

On the basis of the tests of order the null hypothesis was rejected ($p < .01$) for only two of the 64 time periods, indicating there was no significant gain in information from the higher order models, and that the data were to be treated as first order. The seventh time period of Dimension One (Source of Information) of Group I ($X^2 = 64.98$), and the fourth time period of Dimension Four (Reduction of Equivocality) of Group II ($X^2 = 114.04$) were both best represented as second order chains. However, since two out of 64 is only slightly better than chance the second order results were not interpreted. Previous stochastic research also strongly indicates that human communication is best represented by a first order Markov

chain (e.g., Ellis, 1977; Ellis & Fisher, 1975; Hawes & Foley, 1976).

Homogeneity

The null hypothesis that the transition matrices for the two groups were equal was rejected ($p < .01$) for each of the four SIPA dimensions. Since the transition probabilities differed significantly between groups for each SIPA dimension, the groups could not be considered as originating in the same population. For this reason each group was tested separately in the other analyses.

Stationarity

The overall tests of stationarity, one for each of the four dimensions of SIPA, for both groups led to rejection ($p < .01$) of the null hypothesis that the transition probabilities were constant over the eight time periods within every dimension except Dimension Three (Evolution of Information). The eight time periods within each nonstationary dimension were individually tested to determine which time periods contributed to overall nonstationarity. Table 1 shows the nonstationary (asterisked) time periods for each dimension for Group I; Table 2 reports the results for Group II. The nonstationary time periods in a dimension have transition probabilities from category to category that differ significantly from the composite of all eight time periods. The stationary time periods do not differ significantly from the composite or each other.

Within each nonstationary time period the separate categories or states represented by the rows of the transition matrix were tested to determine which categories of each dimension of SIPA contributed most to the nonstationarity of the time period. Nonstationary categories, those which differed significantly from the composite, are reported in Tables 3 and 4 for Groups I and II.

Insert Tables 1, 2, 3 and 4 about here

DISCUSSION

The Markovian analysis produced the following results; (1) the two groups were communicatively nonhomogeneous; the overall patterns for each group departed significantly from the combined composite of both groups; (2) patterns of communication were nonstationary for three of the four dimensions; Source of Information, Time Orientation, and Equivocality Reduction; (3) patterns of communication were stationary for the Information Evolution dimension throughout the entire life span of each group. In this discussion these results are examined in light of previous theoretical and empirical accounts of small group development. Implications of this study for future research on communicative processes in small groups are also discussed.

Homogeneity

The two groups produced different patterns of information processing behavior. The patterns of communication were expected to be homogeneous because the two groups had many characteristics in common. Both were classroom groups conducted at Harvard University as part of a social psychology course. Each group consisted of twenty-five members; each met for thirty-two, fifty minute sessions. Both leaders adopted a nondirective leadership style. Similar assignments were completed by all members and the goals of each group were the same: personal growth and increased knowledge of group process.

Despite the nonhomogeneity, there were a number of similarities in the groups' information processing behavior. First, the sequence of communication in each group is best explained by a first order Markov

chain. A message category was maximally predicted from knowledge of only the immediately preceding message. Second, Evolution of Information produced stable, though different, patterns for the two groups. Third, the least probable categories (states) were identical for both groups. Fourth, the most probable categories for the composites of three dimensions were the same for both groups: Information was primarily Group-system oriented; Time was usually referred to in the Present; and Equivocality typically decreased over time. The only inconsistent dimension was Evolution of Information. For Group I, Retention was the most probable category, while for Group II Enactment was most probable. Fifth, in both groups an act was usually followed by an act in the same category. When this cycle was broken it was most often by transition to the most probable category. In the Source of Information dimension, for example, messages concerning the Immediately Environing System generated further talk of the Immediately Environing System, but eventually the conversation turned to the Group-system, which was the most probable category.

In light of the similarities in composition and procedure, how can the nonhomogeneity be explained? One possibility is that compositional and procedural factors are not sufficient to explain developmental patterns and end states. The principle of multifinality suggests that systems with similar initial conditions (e.g., composition) may evolve to different end states. As Watzlawick, Beavin and Jackson (1967) observe, "system parameters will predominate over initial conditions [p. 127]."

It is also possible that the temporal divisions used in this study were very sensitive to differences among the groups. Previous group development studies have only looked for three or four group

phases, whereas this study investigated eight potential phases. Just as "birth-growth-death" is representative of the gross development pattern of most humans, many of the "birth-growth-maturity" models of group development are representative of most groups in a general way. The finer levels of analysis made possible by the Markov model used in this study allowed the researcher to uncover differences between similar systems. Other researchers using Markov analysis have reported nonhomogeneity among sample groups similar in type (e.g., Ellis, 1977; Hawes & Foley, 1976). Thus, Markov analysis seems especially sensitive to these differences.

Group development researchers using more traditional methods have tended to focus on gross similarities among groups. For example, Bales and Strodtbeck's (1951) model predicts three major phases of development: orientation, evaluation and control, but does not account for intra-phase activity. The present study suggests it is possible to systematically refine group analysis and focus on differences between similar groups. This level of analysis is not feasible with a more general model.

The differences identified by the homogeneity test represent different patterns of change over time in the groups. The basic elements of these patterns are phases of information processing behavior. The location of the phases was identifiable primarily from the stationarity tests, which indicated where major changes in communication took place over the groups' life spans. Insight into the nature of the developmental patterns was provided by an analysis of interacts and acts in the different phases.

It was originally thought that the interact level of analysis would provide the best description of phases. However, the interact

level did not contribute significantly to the interpretation of developmental patterns. The changes in interact probabilities were mirrored by category probabilities; therefore, most information derived by interpreting the complex interact level was also available from interpreting the single act level. This was true despite the fact that the statistical tests were conducted at the interact level. The reason for the low information yield of the interact is primarily conceptual. In order to derive meaning from interact analysis, a conceptual definition of various interacts must be created. However, it was difficult to interpret the meaning of interacts in the SIPA category system. For example, the digital translation of an Individual to Group-system interact, or an Individual to Environment interact in Dimension One is unclear, making it difficult to evaluate change from one interact to the other. Only in Evolution of Information was the functional meaning of an interact interpretable. Any category followed by Negative Selection could be considered a conflict interact, and an act followed by Positive Selection was an agreement interact. Changes in types and frequencies of interacts in Dimension Three, therefore, can be interpreted in terms of agreement/disagreement, controversy, or possibly conflict. Unfortunately, however, Negative and Positive Selection were only minimally used by the groups, yielding little information about these processes.

Changes in information processing were identifiable primarily from the single act category probabilities. The pattern of changes comprises the phases of development for each group. These phases and the correspondence between SIPA categories and important small group issues will become evident in discussion of the changes in each dimension of SIPA.

Dimension One: Source of Information

The Source of Information Dimension contained four categories. Group-system (category two) is equivalent to the "here" of "here and now" in training group language (see, e.g., Egan, 1970). This category refers to either messages about the relationships between group members, members' reactions to each other or reactions to group issues. Group-system reflects the group's level of intimacy, their interpersonal contact.

Immediately Environing System (category three) and Environment (category four) are equivalent to the "there" in "there and then." "There" messages deal with information outside of the immediate group system. The remaining category, Individual (category one), represents short descriptions of personal experience or private information, e.g., self-disclosure. It can include messages which are either internal or external to the group.

Previous studies (e.g., Semrad, 1966; Yalom, 1970) indicate that self-analytic groups typically begin with low levels of intimacy ("in here" messages) and evolve linearly to higher levels, gradually becoming closeknit work groups capable of dealing successfully with interpersonal issues and problems. The groups in this study showed the predicted trend, but with an interesting difference.

For Group I, the patterns consisted mainly of fluctuating frequencies in Group-system and Immediately Environing System messages. From an initial orientation phase (high "out there") the group moved to a premature intimacy stage (high "in here"), followed by a gradual tapering off of intimacy, and an increase in Immediately Environing System ("there" messages). In the final time period, there was a resurgence of intimacy and a decrease in references to outside experiences.

Group II wavered between periods of high and moderate intimacy. This group buffered intimacy with "out there" oriented individual and environmental messages.

Consistent with patterns found in previous research, these groups attained increasingly higher levels of intimacy over time, however, Group II showed a decrease during the final time period. The major difference, though, is that developmental patterns were cyclical not linear. The groups began with low intimacy. Intimacy increased considerably, then tapered off in the second stage. In the final stage, intimacy gradually increased to its highest point. The stages were much more pronounced in Group I than Group II. For example, the termination period was associated with greatly increased intimacy for Group I, while Group II showed only a slight decrease in intimacy.

Despight the predominance of the linear model, the concept of cyclical stages is not new to the area of self-analytic group development; Bion (1959) and Schutz (1958), for example, have proposed cyclical theoretical models. Gibbard and Hartman (1973), Heinicke and Bales (1953), and McMurrain and Gazda (1974) have also found non-linear development in empirical analyses of groups. The results of this investigation further support the cyclical model.

Dimension Two: Time Orientation

The Time Orientation dimension classifies the temporal referent of messages: Past, Present, Future or Timeless Present. Present (category two) corresponds to the "now" of "here and now." It suggests the group is dealing with issues immediately, as they arise. Past (category one) refers to events which have already occurred; Future (category three) refers to events which may occur, for example, how

the group can achieve its goals; and Timeless Present (category Four) refers to events which are generalizable across time boundaries, e.g., "After a war the national economy tends to go down." These latter three categories correspond to the "then" of "there and then," which is indicative of the group's tendency to take "flight" from intimacy or "work" (e.g., Egan, 1970). Previous research suggests that groups begin with low emphasis on "now" and linearly increase emphasis over time (e.g., Talom, 1970). The groups in this study did not conform to this pattern.

Group I was characterized by high levels of "now" referents throughout its life span. The emphasis on "now" (Present), however, declined moderately over time. Group I began with a moderately high number of "now" messages, moved swiftly to a peak, then declined slightly, increased again, dropped sharply as the group neared its termination, and rose sharply in the last period, but without reaching its previous peak. The "then" categories formed a reciprocal pattern.

Group II began with strong emphasis on "then." The Present category increased sharply after the second time period, then declined slightly, rose to its highest level near the end of the group, but declined in the final period.

Changes in Time Orientation were clearly nonlinear. There was no evidence of gradually increasing talk about the present ("now"). Both groups developed in a cyclical fashion with low periods of "now" talk coming in the middle and near the end of group life. The groups counter-balanced periods of high "nows" with periods of low "nows" and high "thens." Low intimacy in the beginning of group life is probably attributable to the task at hand, e.g., discussing meeting times and exchanging individual biographies (e.g., " My major last

semester was biology.") Once the group members began feeling close, they counter-balanced by pulling back; but withdrawal was soon followed by attempts to achieve closeness again. The overall cycle was one of approach-avoidance, influenced by a tendency to seek comfortable levels of closeness and distance.

Both groups were characterized by withdrawal near the end of the life cycle. This may be due to the anxiety associated with termination, the death of the group. Metaphorically these groups were diffident toward death. In Group I the final period was characterized by talk of the "way we were" (Past) or the impending termination (Future). Group II, on the other hand, seemed to deny group death. This group only dealt with imminent separation very late in its life, and then only by discussing "what I got out of the group" (Past).

Dimension Three: Evolution of Information

The Evolution of Information dimension classifies communication according to several functions: providing or requesting information, agreeing, disagreeing, and providing neutral opinion. Both groups were stationary on this dimension, establishing patterns early and maintaining them throughout all eight time periods.

Group I maintained high levels of neutral opinion throughout, with moderately low representation of information and disagreement. Group II was moderately high on information, moderate on opinion, and low in both agreement and disagreement.

Surprisingly, there was a low frequency of agreement and disagreement in both groups, suggesting an affectively neutral climate. This interpretation, however, does not match the nomic character of self-analytic groups. The low frequencies may be due to the absence

of explicit task goals. Self-analytic groups are usually concerned more with expressing feelings than with debating possible solutions to problems. Negative and positive reactions in such groups are more a matter of affect than the categories of agreement or disagreement imply. The SIPA dimensions simply do not tap this affective domain.

Although not categorized in this study, negative affect was evident in the taped messages of Group II, particularly in paralinguistic expression such as voice inflection. Negative affect was also apparent in the dialogue of both groups, e.g., "You feel threatened?" "Yes. Threatened." (from the transcript of Group I). Group members verbally expressed discomfort, anger, fear, dissatisfaction and discontent. They also expressed positive affect both verbally and nonverbally. The positive and negative affect, however, would not necessarily show up in the Agreement and Disagreement categories of SIPA. SIPA was not sufficiently sensitive to indicants of supportive and defensive behavior in these groups.

Dimension Four: Reduction of Equivocality

Dimension Four classifies the degree of certainty in communication. The five categories range from Maximum Reduction of Uncertainty of Maximum Increase of Uncertainty. As might be expected in groups whose goals and purposes are amorphous and unclearly delineated, there was moderately high equivocality in both groups. Group I maintained a stable balance of moderately high equivocality increase, and moderate equivocality reduction throughout its life (approximately .70:.30). Group II began with high equivocality increase and low equivocality reduction (approximately .85:.15). "Increase" linearly decreased and "Reduction" linearly increased, converging at moderate increase and

moderate reduction (approximately .50:.50).

The relatively high amount of equivocality in the groups may be a result of the groups' attempts to maintain harmony. These groups were not highly dogmatic; members did not insist on expressing inflexible positions. Williams and Gross' (1975) study of equivocation and character rating is relevant to the present findings. They found that an equivocated message yielded higher character ratings for the speaker and more agreement. It also helped preserve credibility better than a clearly stated disagreeable message. Moderate equivocality may therefore, help promote trust.

The high equivocality may also be due to the nature of the subject matter discussed in these groups. Self-analytic groups with relatively nondirective leaders are often characterized by high uncertainty about how to proceed and what behaviors are appropriate (norms). Interestingly, Group I, with high information on the Evolution of Information dimension, showed higher equivocality than Group II. This finding implies that even though much information was offered and requested, few conclusions were reached. Group II with high neutral opinion, had only moderate equivocality, indicating this type of communication may have led to more singular and definite interpretations or conclusions. Neutral opinion was more instrumental than information in reducing equivocality.

SUMMARY AND CONCLUSIONS

First, although the groups were similar in terms of compositional and procedural factors, their patterns of information processing were different. The differences were discovered as a result of the precision made possible by the Markov analysis and the time sampling. Studies at more discriminating levels of analysis should routinely include examin-

ation of homogeneity of sample groups. Collapsing dissimilar groups may yield a composite that fits no single group.

Second, the microscopic view provided by the Markov analysis suggests that groups develop through many more stages than has been suggested by previous macro models.

Third, the observed interactional patterns did not change linearly in Source of Infromation, Time Orientation, or Evolution of Infromation. Cyclical patterns were evident, suggesting that linearity must be demonstrated, not assumed.

Fourth, the groups did not show evidence of a higher order "work" state (e.g., high "here and now") in the final stages of the life cycle, even after 32 hours of meetings, as has been suggested by other writers. It is also possible that neither group completed a full life cycle, i.e., achieved significant self-awareness and personal growth. An important advantage of the Markov model over previous group development models is that it allows the developmental pattern to emerge from the data, rather than imposing it upon the data. This requires a finer level of analysis and larger data sample than previous models, but yields more information and greater precision.

Fifth, development of the various dimensions occurred at different rates and in different patterns. Researchers cannot examine several dimensions or aspects of group behavior together and collapse them into one developmental model without risking the possibility of obscuring important developmental differences.

Sixth, organized and stable patterns of information evolution were developed early and maintained throughout group life. Time dependence (change) cannot always be assumed in group behavior over time.

Seventh, the interact level of analysis was not particularly

informative. The lack of clear conceptual definitions for interacts and of the meaning of transitional changes resulted in little information gain over and above what was revealed by unit probabilities. Most frequent transitions were to the most probable category or to the same category. The large number of "category to self" interacts suggested a need for more molar units of behavior. A sequence of identically categorized acts, for example, might serve as the unit, thus eliminating the low information yielding "category to self" interact.

Eighth, SIPA was most informative at the level of category probabilities. Obviously, one can only extract from a study, what his/her research tools permit. The SIPA category system undoubtedly constrained this study's information yield. This was partly by design.

The results of this study provide support for previous group developmental research, but also raise questions about the findings and methods of certain studies. This study supports a cyclical model of group development and the existence of developmental changes over the course of group life, but it also reveals that developmental patterns are contingent upon what is observed. In some cases the pattern is constant. This study also supports the feasibility and utility of more precise micro-analysis of groups than has been previously attempted, and the pragmatics of looking for differences in the face of similarity.

The emergence of irregularly spaced phases raises the question of how valid it is to apply a three or four phase model to thirds or quarters of the group's life span (e.g., Bales and Strodtbeck 1951). Further, the finding of nonhomogeneity challenges a practice used in virtually every group development study, that of collapsing similar types of groups for analysis.

And finally, the "nonprogressive" developmental patterns observed in this study cast doubt on the prevailing assumption of many theorists (e.g., Tuckman, 1965; Bennis & Shepard, 1956) that all groups move steadily to a mature "work" or performance state.

The study also generated several questions for future research:

First, future investigators should work on identifying the various possible cyclical patterns of development. Is there a finite variety of cycles, and if so, what are their characteristics?

Second, we should more fully define information processing. What are other dimensions of information processing? Should affective and relational level dimensions, for example, be added to SIPA?

Third, this study used a relatively fine level of analysis. What parameters should impinge on the decision to employ fine versus coarse or gross analyses?

Fourth, the stochastic analysis made possible a study of interaction patterns. Future research should develop ways to investigate communicative transaction.

Fifth, the interact proved only minimally informative. How can category systems and analytic techniques be modified to maximize information yield from combinations of acts in a sequence?

Sixth, what content and thematic variables correlate with developmental patterns? Do any group parameters (e.g., context, leadership) influence the patterns of group development?

Finally, there is a need for more long term studies which focus on entire life-spans of groups, so we can begin making cross study comparisons.

NOTES

1. This paper is based in part on the author's doctoral dissertation, under the direction of Arthur Bochner, Temple University, 1977.
2. Self-analytic groups are defined by Dunphy (1974) as, "groups such as therapy and T-groups, where a major part of the group task is the development of a greater sensitivity to and understanding of the motivations, emotions, and defenses of the group members (including oneself) and to interpersonal and group processes within the group itself [p. 300]." Although there may be important differences between subtypes such as therapy, encounter, sensitivity training, T- or personal growth groups, all qualify as self-analytic groups.
3. A minimum of 250 messages was found necessary to insure that results were not artifactual in each cluster (T. Glover, personal communication, May, 1977). Glover, formerly associated with the University of Utah, is a communications consultant in Salt Lake City, and the creator of the Markov chain program used in the analysis.

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Table 1

Stationarity Test for Group I

Dimension	df	Time Period 1	2	3	4	5	6	7	
I. Source of Information	12	35.72*	19.59	37.75*	7.65	26.61*	16.06	15.30	3
II. Time Orientation	12	16.88	18.74	19.14	22.76	13.03	16.91	44.95*	
III. Evolution of Information	12	18.75	12.42	14.38	14.80	20.66	18.68	5.50	2
IV. Reduction of Equivocality	20	32.18	35.19	37.06	22.94	18.73	25.56	23.23	5

Note.- Statistic reported is Anderson-Goodman (1957) with a chi-square distribution.
*Nonstationary time periods ($p < .01$).

Table 2

Stationarity Test for Group II

Dimension	df	Time Period 1	2	3	4	5	6	7	8
I. Source of Information	12	240.99*	42.28*	14.17	30.30*	67.71*	18.35	37.02*	14.50
II. Time Orientation	12	134.88*	19.43	18.59	40.53*	29.08*	30.88*	33.12*	23.33
III. Evolution of Information	12	24.61	7.40	17.75	14.88	4.74	8.46	7.59	16.70
IV. Reduction of Equivocality	20	133.50*	78.20*	81.27*	55.61*	67.27*	89.25*	76.75*	91.62*

Note.- Statistic reported is Anderson-Goodman (1957) with a chi-square distribution.
*Nonstationary time periods ($p < .01$).

Table 3

Nonstationary* Categories for Group I

Time Period	Dimension I. Source of Information Category A-G*	II. Time Orientation Category A-G	III. Evolution of Information Category A-G	IV. Reduction of Equivocality Category A-G
1	1, Individual 19.22		(All stationary)	
2				
3	3, Immediately Environing System 28.84			
4				
5	2, Group-system 14.13			
6				
7		1, Past-to-present 20.10 2, Present-to present 11.78		
8	2, Group-system 20.29			1, Maximum reduction of Equivocality 15.79 5, Maximum increase of Equivocality 18.37

[a]Statistic reported is Anderson-Goodman (1957) with a chi-square distribution.

*$p < .01$.

Table 4

Nonstationary* Categories for Group II

	Dimension			
	I. Source of Information	II. Time Orientation	III. Evolution of Information	IV. Reduction of Equivocality
	Category A-G[a]	Category A-G	Category A-G	Category A-G
Time Period				
1	1, Individual 33.59 2, Group-system 156.92 4, Environment 46.50	1, Past-to-present 25.21 2, Present-to-present 92.78 3, Future-to-present 14.76	(All Stationary)	1, Maximum Reduction of Equivocality 42.99 4, Moderate Increase of Equivocality 49.85 5, Maximum Increase of Equivocality 30.22
2	2, Group-system 17.88			4, Moderate Increase of Equivocality 33.75 5, Maximum Increase of Equivocality 31.79
3				4, Moderate Increase of Equivocality 44.36 5, Maximum Increase of Equivocality 17.68
4	2, Group-system 15.93	2, Present-to-present 22.04		1, Maximum reduction of Equivocality 15.19

Table 4, continued

	I. Source of Information	II. Time Orientation	III. Evolution of Information	IV. Reduction of Equivocality
4, cont.				4, Moderate reduction of Equivocality 30.30
5	2, Group-system 50.74	4, Timeless Present 16.40	(All Stationary)	2, Moderate Reduction of Equivocality 13.62 4, Moderate Increase of Equivocality 30.40
6		2, Present-to-present 21.27		2, Moderate Reduction of Equivocality 23.71 4, Moderate Increase of Equivocality 45.08
7	3, Immediately Environing System 20.15	2, Present-to-present 15.28		4, Moderate Increase of Equivocality 30.21 5, Maximum Increase of Equivocality 30.14
8				4, Moderate Increase of Equivocality 43.74 5, Maximum Increase of Equivocality 21.88

[a]Statistic reported is Anderson-Goodman (1957) with a chi-square distribution.

*$p < .01$.